

03110023

# 证 明

## CERTIFICATE

本证明之附件是向中国专利局作为受理局提交的下列国际申请副本  
THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY OF THE BELOW  
IDENTIFIED INTERNATIONAL APPLICATION THAT WAS FILED WITH THE  
CHINESE PATENT OFFICE AS RECEIVING OFFICE

国际申请号: PCT/CN03/00570

INTERNATIONAL APPLICATION NUMBER

国际申请日: 18 JUL 2003(18.07.03)

INTERNATIONAL FILING DATE

发明名称: An Improved Method of Head Stack Assembly Flexible

TITLE OF INVENTION

Circuit Assembly Attached to an Actuator arm

申请人: SAE MAGNETICE(H.K.)LTD

APPLICANT

中华人民共和国国家知识产权局局长  
COMMISSIONER OF THE STATE INTELLECTUAL PROPERTY  
OFFICE OF THE PEOPLE'S REPUBLIC OF CHINA

王景川

二零零三年七月十日

JULY 10, 2003

## PCT

## REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

PCT/CN 03/0 0570

International Filing Date

18 JUL 2003  
18.07.03

Name of receiving Office and

RO/CN 中华人民共和国国家知识产权局  
PCT International Application

Applicant's or agent's file reference

(if desired) (12 characters maximum) FPEL03150023

<b>Box No. I TITLE OF INVENTION</b>	
An Improved Method of Head Stack Assembly Flexible Circuit Assembly Attached to an Actuator Arm	
<b>Box No. II APPLICANT</b> <input type="checkbox"/> This person is also inventor	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)	
SAE MAGNETICS (H. K. ) LTD. SAE Tower, 38-42 Kwai Fung Crescent Kwai Chung N. T. Hong Kong Special Administrative Region, P. R. of China	
State (that is, country) of nationality: CN	State (that is, country) of residence: CN
This person is applicant for the purposes of: <input checked="" type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box	
<b>Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)</b>	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)	
HO, Yiusing Flat B, 12/F, Block 1, Bayshore Towers Ma On Shan, Shatin, N. T., Hong Kong Special Administrative Region P. R. of China	
State (that is, country) of nationality:	State (that is, country) of residence:
This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box	
<input checked="" type="checkbox"/> Further applicants and/or (further) inventors are indicated on a continuation sheet.	
<b>Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE</b>	
The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: <input checked="" type="checkbox"/> agent <input type="checkbox"/> common representative	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)	
CHINA PATENT AGENT (H.K.) LTD. 22/F, Great Eagle Centre 23 Harbour Road, Wanchai Hong Kong Special Administrative Region The People's Republic of China	
Telephone No. (852)28284688	Facsimile No. (852)28271018
Teleprinter No.	
Agent's registration No. with the Office	
<input type="checkbox"/> Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.	

Sheet No. ...2...

Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)	
If none of the following sub-boxes is used, this sheet should not be included in the request.	
<p>Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)</p> <p>FUKAYA Hiroshi c/o SAE Magnetics (H.K.) Ltd. SAE Tower 38-42 Kwai Fung Crescent, Kwai Chung, N. T., Hong Kong Special Administrative Region P. R. of China</p>	<p>This person is:</p> <p><input type="checkbox"/> applicant only</p> <p><input type="checkbox"/> applicant and inventor</p> <p><input checked="" type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)</p> <p>Applicant's registration No. with the Office</p>
State (that is, country) of nationality:	State (that is, country) of residence:
<p>This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box</p>	
<p>Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)</p> <p>YIP, Kamfung c/o SAE Magnetics (H.K.) Ltd. SAE Tower 38-42 Kwai Fung Crescent, Kwai Chung, N. T., Hong Kong Special Administrative Region P. R. of China</p>	<p>This person is:</p> <p><input type="checkbox"/> applicant only</p> <p><input type="checkbox"/> applicant and inventor</p> <p><input checked="" type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)</p> <p>Applicant's registration No. with the Office</p>
State (that is, country) of nationality:	State (that is, country) of residence:
<p>This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box</p>	
<p>Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)</p> <p>YAMAGUCHI Satoshi c/o SAE Magnetics (H.K.) Ltd. SAE Tower 38-42 Kwai Fung Crescent, Kwai Chung, N. T., Hong Kong Special Administrative Region P. R. of China</p>	<p>This person is:</p> <p><input type="checkbox"/> applicant only</p> <p><input type="checkbox"/> applicant and inventor</p> <p><input checked="" type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)</p> <p>Applicant's registration No. with the Office</p>
State (that is, country) of nationality:	State (that is, country) of residence:
<p>This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box</p>	
<p>Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)</p> <p>WANG, Jeffery L. HOUSE NO. 34, 18TH STREET HONG LOK YUEN, TAI PO, N.T., HONG KONG SPECIAL ADMINISTRATIVE REGION P. R. OF CHINA</p>	<p>This person is:</p> <p><input type="checkbox"/> applicant only</p> <p><input type="checkbox"/> applicant and inventor</p> <p><input checked="" type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)</p> <p>Applicant's registration No. with the Office</p>
State (that is, country) of nationality:	State (that is, country) of residence:
<p>This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box</p>	
<p><input checked="" type="checkbox"/> Further applicants and/or (further) inventors are indicated on another continuation sheet.</p>	

## Box No. V DESIGNATION OF STATES

Mark the applicable check-boxes below; at least one must be marked.

The following designations are hereby made under Rule 4.9(a):

## Regional Patent

- ☐ AP ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, MZ Mozambique, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZM Zambia, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT (if other kind of protection or treatment desired, specify on dotted line) .....
- ☐ EA Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☐ EP European Patent: AT Austria, BE Belgium, BG Bulgaria, CH & LI Switzerland and Liechtenstein, CY Cyprus, CZ Czech Republic, DE Germany, DK Denmark, EE Estonia, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, HU Hungary, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, RO Romania, SE Sweden, SI Slovenia, SK Slovakia, TR Turkey, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☐ OA OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GQ Equatorial Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line) .....

## National Patent (if other kind of protection or treatment desired, specify on dotted line):

- |  |   |  |
|--|---|--|
| <input type="checkbox"/> AE United Arab Emirates               | <input type="checkbox"/> HR Croatia                                   | <input type="checkbox"/> OM Oman                             |
| <input type="checkbox"/> AG Antigua and Barbuda                | <input type="checkbox"/> HU Hungary                                   | <input type="checkbox"/> PG Papua New Guinea                 |
| <input type="checkbox"/> AL Albania                            | <input type="checkbox"/> ID Indonesia                                 | <input type="checkbox"/> PH Philippines                      |
| <input type="checkbox"/> AM Armenia                            | <input type="checkbox"/> IL Israel                                    | <input type="checkbox"/> PL Poland                           |
| <input type="checkbox"/> AT Austria                            | <input type="checkbox"/> IN India                                     | <input type="checkbox"/> PT Portugal                         |
| <input type="checkbox"/> AU Australia                          | <input type="checkbox"/> IS Iceland                                   | <input type="checkbox"/> RO Romania                          |
| <input type="checkbox"/> AZ Azerbaijan                         | <input type="checkbox"/> JP Japan                                     | <input type="checkbox"/> RU Russian Federation               |
| <input type="checkbox"/> BA Bosnia and Herzegovina             | <input type="checkbox"/> KE Kenya                                     |  |
| <input type="checkbox"/> BB Barbados                           | <input type="checkbox"/> KG Kyrgyzstan                                | <input type="checkbox"/> SC Seychelles                       |
| <input type="checkbox"/> BG Bulgaria                           | <input type="checkbox"/> KP Democratic People's Republic of Korea     | <input type="checkbox"/> SD Sudan                            |
| <input type="checkbox"/> BR Brazil                             | <input type="checkbox"/> KR Republic of Korea                         | <input type="checkbox"/> SE Sweden                           |
| <input type="checkbox"/> BY Belarus                            | <input type="checkbox"/> KZ Kazakhstan                                | <input type="checkbox"/> SG Singapore                        |
| <input type="checkbox"/> BZ Belize                             | <input type="checkbox"/> LC Saint Lucia                               | <input type="checkbox"/> SK Slovakia                         |
| <input type="checkbox"/> CA Canada                             | <input type="checkbox"/> LK Sri Lanka                                 | <input type="checkbox"/> SL Sierra Leone                     |
| <input type="checkbox"/> CH & LI Switzerland and Liechtenstein | <input type="checkbox"/> LR Liberia                                   | <input type="checkbox"/> SY Syrian Arab Republic             |
| <input checked="" type="checkbox"/> CN China                   | <input type="checkbox"/> LS Lesotho                                   | <input type="checkbox"/> TJ Tajikistan                       |
| <input type="checkbox"/> CO Colombia                           | <input type="checkbox"/> LT Lithuania                                 | <input type="checkbox"/> TM Turkmenistan                     |
| <input type="checkbox"/> CR Costa Rica                         | <input type="checkbox"/> LU Luxembourg                                | <input type="checkbox"/> TN Tunisia                          |
| <input type="checkbox"/> CU Cuba                               | <input type="checkbox"/> LV Latvia                                    | <input type="checkbox"/> TR Turkey                           |
| <input type="checkbox"/> CZ Czech Republic                     | <input type="checkbox"/> MA Morocco                                   | <input type="checkbox"/> TT Trinidad and Tobago              |
| <input type="checkbox"/> DE Germany                            | <input type="checkbox"/> MD Republic of Moldova                       |  |
| <input type="checkbox"/> DK Denmark                            | <input type="checkbox"/> MG Madagascar                                | <input type="checkbox"/> TZ United Republic of Tanzania      |
| <input type="checkbox"/> DM Dominica                           | <input type="checkbox"/> MK The former Yugoslav Republic of Macedonia | <input type="checkbox"/> UA Ukraine                          |
| <input type="checkbox"/> DZ Algeria                            | <input type="checkbox"/> MN Mongolia                                  | <input type="checkbox"/> UG Uganda                           |
| <input type="checkbox"/> EC Ecuador                            | <input type="checkbox"/> MW Malawi                                    | <input type="checkbox"/> US United States of America         |
| <input type="checkbox"/> EE Estonia                            | <input type="checkbox"/> MX Mexico                                    |  |
| <input type="checkbox"/> ES Spain                              | <input type="checkbox"/> MZ Mozambique                                | <input type="checkbox"/> UZ Uzbekistan                       |
| <input type="checkbox"/> FI Finland                            | <input type="checkbox"/> NI Nicaragua                                 | <input type="checkbox"/> VC Saint Vincent and the Grenadines |
| <input type="checkbox"/> GB United Kingdom                     | <input type="checkbox"/> NO Norway                                    | <input type="checkbox"/> VN Viet Nam                         |
| <input type="checkbox"/> GD Grenada                            | <input type="checkbox"/> NZ New Zealand                               | <input type="checkbox"/> YU Serbia and Montenegro            |
| <input type="checkbox"/> GE Georgia                            |   | <input type="checkbox"/> ZA South Africa                     |
| <input type="checkbox"/> GH Ghana                              |   | <input type="checkbox"/> ZM Zambia                           |
| <input type="checkbox"/> GM Gambia                             |   | <input type="checkbox"/> ZW Zimbabwe                         |

Check-boxes below reserved for designating States which have become party to the PCT after issuance of this sheet:

☐ ..... ☐ ..... ☐ .....

**Precautionary Designation Statement:** In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)

## Supplemental Box

*If the Supplemental Box is not used, this sheet should not be included in the request.*

1. *If, in any of the Boxes, except Boxes Nos. VIII(i) to (v) for which a special continuation box is provided, the space is insufficient to furnish all the information: in such case, write "Continuation of Box No. ...." (indicate the number of the Box) and furnish the information in the same manner as required according to the captions of the Box in which the space was insufficient, in particular:*
  - (i) *if more than two persons are to be indicated as applicants and/or inventors and no "continuation sheet" is available: in such case, write "Continuation of Box No. III" and indicate for each additional person the same type of information as required in Box No. III. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below;*
  - (ii) *if, in Box No. II or in any of the sub-boxes of Box No. III, the indication "the States indicated in the Supplemental Box" is checked: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the applicant(s) involved and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is applicant;*
  - (iii) *if, in Box No. II or in any of the sub-boxes of Box No. III, the inventor or the inventor/applicant is not inventor for the purposes of all designated States or for the purposes of the United States of America: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the inventor(s) and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is inventor;*
  - (iv) *if, in addition to the agent(s) indicated in Box No. IV, there are further agents: in such case, write "Continuation of Box No. IV" and indicate for each further agent the same type of information as required in Box No. IV;*
  - (v) *if, in Box No. V, the name of any State (or OAPI) is accompanied by the indication "patent of addition," or "certificate of addition," or if, in Box No. V, the name of the United States of America is accompanied by an indication "continuation" or "continuation-in-part": in such case, write "Continuation of Box No. V" and the name of each State involved (or OAPI), and after the name of each such State (or OAPI), the number of the parent title or parent application and the date of grant of the parent title or filing of the parent application;*
  - (vi) *if, in Box No. VI, there are more than five earlier applications whose priority is claimed: in such case, write "Continuation of Box No. VI" and indicate for each additional earlier application the same type of information as required in Box No. VI.*
2. *If, with regard to the precautionary designation statement contained in Box No. V, the applicant wishes to exclude any State(s) from the scope of that statement: in such case, write "Designation(s) excluded from precautionary designation statement" and indicate the name or two-letter code of each State so excluded.*

Continuation of Box No. III

CHEN, Canhua  
 Winnerway Industrial Area  
 Nancheng, Dongguan City  
 Guangdong Province,  
 P. R. of China Zip Code: 511700

This person is inventor only

Sheet No. ... 5 ...

**Box No. VI PRIORITY CLAIM**

The priority of the following earlier application(s) is hereby claimed:

Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country or Member of WTO	regional application:* regional Office	international application: receiving Office
item (1)				
item (2)				
item (3)				
item (4)				
item (5)				

☐ Further priority claims are indicated in the Supplemental Box.

The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of this international application is the receiving Office) identified above as:

☐ all items    ☐ item (1)    ☐ item (2)    ☐ item (3)    ☐ item (4)    ☐ item (5)    ☐ other, see Supplemental Box

\* Where the earlier application is an ARIPO application, indicate at least one country party to the Paris Convention for the Protection of Industrial Property or one Member of the World Trade Organization for which that earlier application was filed (Rule 4.10(b)(ii)): .....

**Box No. VII INTERNATIONAL SEARCHING AUTHORITY**

Choice of International Searching Authority (ISA) (if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):

ISA / CN .....

Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):

Date (day/month/year)

Number

Country (or regional Office)



**Box No. VIII DECLARATIONS**

The following declarations are contained in Boxes Nos. VIII (i) to (v) (mark the applicable check-boxes below and indicate in the right column the number of each type of declaration):

Number of  
declarations

- |   |  |  |
|---|--|--|
| <input type="checkbox"/> Box No. VIII (i)   | Declaration as to the identity of the inventor   |  |
| <input type="checkbox"/> Box No. VIII (ii)  | Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent             |  |
| <input type="checkbox"/> Box No. VIII (iii) | Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application |  |
| <input type="checkbox"/> Box No. VIII (iv)  | Declaration of inventorship (only for the purposes of the designation of the United States of America)                               |  |
| <input type="checkbox"/> Box No. VIII (v)   | Declaration as to non-prejudicial disclosures or exceptions to lack of novelty   |  |

Sheet No. 6

Box No. IX CHECK LIST; LANGUAGE OF FILING																																																								
<p>This international application contains:</p> <p>(a) In paper form, the following number of sheets:</p> <table style="width: 100%; border-collapse: collapse;"> <tr><td>request (including declaration sheets)</td><td style="text-align: right;">6</td></tr> <tr><td>description (excluding sequence listings and/or tables related thereto)</td><td style="text-align: right;">5</td></tr> <tr><td>claims</td><td style="text-align: right;">4</td></tr> <tr><td>abstract</td><td style="text-align: right;">1</td></tr> <tr><td>drawings</td><td style="text-align: right;">5</td></tr> <tr><td>Sub-total number of sheets</td><td style="text-align: right;">21</td></tr> <tr><td>sequence listings</td><td></td></tr> <tr><td>tables related thereto</td><td></td></tr> <tr><td colspan="2"><i>(for both, actual number of sheets if filed in paper form, whether or not also filed in computer readable form; see (c) below)</i></td></tr> <tr><td>Total number of sheets</td><td style="text-align: right;">21</td></tr> </table> <p>(b) <input type="checkbox"/> only in computer readable form (Section 801(a)(i))</p> <p style="margin-left: 20px;">(i) <input type="checkbox"/> sequence listings</p> <p style="margin-left: 20px;">(ii) <input type="checkbox"/> tables related thereto</p> <p>(c) <input type="checkbox"/> also in computer readable form (Section 801(a)(ii))</p> <p style="margin-left: 20px;">(i) <input type="checkbox"/> sequence listings</p> <p style="margin-left: 20px;">(ii) <input type="checkbox"/> tables related thereto</p> <p>Type and number of carriers (diskette, CD-ROM, CD-R or other) on which are contained the</p> <p><input type="checkbox"/> sequence listings: .....</p> <p><input type="checkbox"/> tables related thereto: .....</p> <p><i>(additional copies to be indicated under items 9(ii) and/or 10(ii), in right column)</i></p>	request (including declaration sheets)	6	description (excluding sequence listings and/or tables related thereto)	5	claims	4	abstract	1	drawings	5	Sub-total number of sheets	21	sequence listings		tables related thereto		<i>(for both, actual number of sheets if filed in paper form, whether or not also filed in computer readable form; see (c) below)</i>		Total number of sheets	21	<p>This international application is accompanied by the following item(s) <i>(mark the applicable check-boxes below and indicate in right column the number of each item)</i>:</p> <table style="width: 100%; border-collapse: collapse;"> <tr><td>1. <input checked="" type="checkbox"/> fee calculation sheet</td><td style="text-align: right;">1</td></tr> <tr><td>2. <input checked="" type="checkbox"/> original separate power of attorney</td><td style="text-align: right;">1</td></tr> <tr><td>3. <input type="checkbox"/> original general power of attorney</td><td></td></tr> <tr><td>4. <input type="checkbox"/> copy of general power of attorney; reference number, if any: .....</td><td></td></tr> <tr><td>5. <input type="checkbox"/> statement explaining lack of signature</td><td></td></tr> <tr><td>6. <input type="checkbox"/> priority document(s) identified in Box No. VI as item(s): .....</td><td></td></tr> <tr><td>7. <input type="checkbox"/> translation of international application into <i>(language)</i>: .....</td><td></td></tr> <tr><td>8. <input type="checkbox"/> separate indications concerning deposited microorganism or other biological material</td><td></td></tr> <tr><td>9. <input type="checkbox"/> sequence listings in computer readable form <i>(indicate type and number of carriers)</i></td><td></td></tr> <tr><td style="margin-left: 20px;">(i) <input type="checkbox"/> copy submitted for the purposes of international search under Rule 13ter only (and not as part of the international application):</td><td></td></tr> <tr><td style="margin-left: 20px;">(ii) <input type="checkbox"/> <i>(only where check-box (b)(i) or (c)(i) is marked in left column)</i> additional copies including, where applicable, the copy for the purposes of international search under Rule 13ter</td><td></td></tr> <tr><td style="margin-left: 20px;">(iii) <input type="checkbox"/> together with relevant statement as to the identity of the copy or copies with the sequence listings mentioned in left column</td><td></td></tr> <tr><td>10. <input type="checkbox"/> tables in computer readable form related to sequence listings <i>(indicate type and number of carriers)</i></td><td></td></tr> <tr><td style="margin-left: 20px;">(i) <input type="checkbox"/> copy submitted for the purposes of international search under Section 802(b-quater) only (and not as part of the international application)</td><td></td></tr> <tr><td style="margin-left: 20px;">(ii) <input type="checkbox"/> <i>(only where check-box (b)(ii) or (c)(ii) is marked in left column)</i> additional copies including, where applicable, the copy for the purposes of international search under Section 802(b-quater)</td><td></td></tr> <tr><td style="margin-left: 20px;">(iii) <input type="checkbox"/> together with relevant statement as to the identity of the copy or copies with the tables mentioned in left column</td><td></td></tr> <tr><td>11. <input type="checkbox"/> other <i>(specify)</i>: .....</td><td></td></tr> </table>	1. <input checked="" type="checkbox"/> fee calculation sheet	1	2. <input checked="" type="checkbox"/> original separate power of attorney	1	3. <input type="checkbox"/> original general power of attorney		4. <input type="checkbox"/> copy of general power of attorney; reference number, if any: .....		5. <input type="checkbox"/> statement explaining lack of signature		6. <input type="checkbox"/> priority document(s) identified in Box No. VI as item(s): .....		7. <input type="checkbox"/> translation of international application into <i>(language)</i> : .....		8. <input type="checkbox"/> separate indications concerning deposited microorganism or other biological material		9. <input type="checkbox"/> sequence listings in computer readable form <i>(indicate type and number of carriers)</i>		(i) <input type="checkbox"/> copy submitted for the purposes of international search under Rule 13ter only (and not as part of the international application):		(ii) <input type="checkbox"/> <i>(only where check-box (b)(i) or (c)(i) is marked in left column)</i> additional copies including, where applicable, the copy for the purposes of international search under Rule 13ter		(iii) <input type="checkbox"/> together with relevant statement as to the identity of the copy or copies with the sequence listings mentioned in left column		10. <input type="checkbox"/> tables in computer readable form related to sequence listings <i>(indicate type and number of carriers)</i>		(i) <input type="checkbox"/> copy submitted for the purposes of international search under Section 802(b-quater) only (and not as part of the international application)		(ii) <input type="checkbox"/> <i>(only where check-box (b)(ii) or (c)(ii) is marked in left column)</i> additional copies including, where applicable, the copy for the purposes of international search under Section 802(b-quater)		(iii) <input type="checkbox"/> together with relevant statement as to the identity of the copy or copies with the tables mentioned in left column		11. <input type="checkbox"/> other <i>(specify)</i> : .....		<p>Number of items</p>
request (including declaration sheets)	6																																																							
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For receiving Office use only		
1. Date of actual receipt of the purported international application:	17 JUL 2003 (17.07.03)	<p>2. Drawings:</p> <p><input checked="" type="checkbox"/> received: <i>fig 1-5</i></p> <p><input type="checkbox"/> not received:</p>
3. Corrected date of actual receipt due to late, but timely received papers or drawings completing the purported international application:	18 JUL 2003 (18.07.03)	
4. Date of timely receipt of the required corrections under PCT Article 11(2):		
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FEE CALCULATION SHEET

Annex to the Request

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International Application No. PCT/CN 03/0 05 70

Applicant's or agent's  
file reference

FPEL03150023

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Applicant

SAE MAGNETICS (H.K.) LTD.

CALCULATION OF PRESCRIBED FEES

1. TRANSMITTAL FEE

CNY500

T

2. SEARCH FEE

CNY1500

S

International search to be carried out by

(If two or more International Searching Authorities are competent to carry out the international search, indicate the name of the Authority which is chosen to carry out the international search.)

3. INTERNATIONAL FEE

Basic Fee

Where items (b) and/or (c) of Box No. IX apply, enter Sub-total number of sheets } 21

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b1 first 30 sheets

CHF650

b1

b2

number of sheets  
in excess of 30

x

fee per sheet

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b2

b3

additional component (only if sequence listings and/or tables related thereto are filed in computer readable form under Section 801(a)(i), or both in that form and on paper, under Section 801(a)(ii)):

400 x

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B

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The international application contains 1 designations.

1

CHF140

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CHF140

D

number of designation fees  
payable (maximum 5)

amount of designation fee

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Add amounts entered at B and D and enter total at I

CHF790

I

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4. FEE FOR PRIORITY DOCUMENT (if applicable)

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5. TOTAL FEES PAYABLE

CNY2000CHF790

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TOTAL

☐ The designation fees are not paid at this time.

MODE OF PAYMENT

☒ authorization to charge  
deposit account (see below)

☐ postal money order

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☒ Authorization to charge the total fees indicated above.

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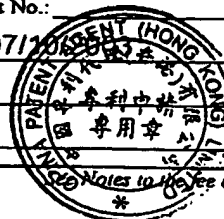
Deposit Account No.:

Date:

07/2003

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CNY 500. /  
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CHF 790. /



## **An Improved Method of Head Stack Assembly Flexible Circuit Assembly Attached to an Actuator Arm**

### **Background Information**

5 [0001] The present invention relates to magnetic hard disk drives. More specifically, the present invention relates to a method of assembling actuator driving mechanisms.

[0002] In the art today, different methods are utilized to improve recording density of hard disk drives. Figure 1 provides an illustration of a typical disk drive.

10 The typical disk drive has a head gimbal assembly (HGA) configured to read from and write to a magnetic hard disk 101. The HGA and the magnetic hard disk 101 are mounted to the base 102 of a main board 103. The disk 101 is rotated relative to the base 102 by a spindle motor 104. The HGA typically includes an actuator arm 105 and a load beam 106. The HGA supports and positions a magnetic

15 read/write slider 107 above the magnetic hard disk 101. The slider may contain transducers to perform the read/write function. The HGA is rotated relative to the base 102 along the axis of a pivot bearing assembly 108 by an actuator frame 109. The actuator frame 109 contains an actuator coil 110 driven by a magnet 111. A relay flexible printed circuit 112 connects a board unit 113 to the transducer of the

20 magnetic read/write slider 107. The signal from the transducer is amplified by the preamplifier 114 before being transmitted along the relay flexible printed circuit.

[0003] The relay flexible printed circuit 112 may be attached by pin soldering. However, the "flux" that is essential for this pin soldering causes a couple of problems. First, the cleaning process must be immediately implemented to remove

25 the flux with soldering. Next, the tin contained in the solder causes pollution of the contacts.

Brief Description Of The Drawings

[0004] Figure 1 provides an illustration of a typical disk drive.

[0005] Figure 2 provides an illustration of one embodiment of a head stack assembly with a flexible circuit substrate.

5 [0006] Figure 3 provides a cross-section illustration of one embodiment of the mounting of the flexible circuit substrate on the actuator arm.

[0007] Figure 4 provides an illustration of an alternate embodiment of a head stack assembly with a flexible circuit substrate.

[0008] Figure 5 provides a cross-section illustration of the alternate embodiment  
10 of the mounting of the flexible circuit substrate on the actuator arm.

Detailed Description

[0009] A method for mounting a head stack assembly (HSA) circuit assembly is disclosed. In one embodiment, a flexible circuit substrate may be coupled to a stiffener. The stiffener may be a metal, such as aluminum, or some other stiff and durable material. The flexible circuit substrate may be made of an organic material and may have a series of electronic leads embedded in the flexible circuit substrate. The flexible substrate may be coupled to the stiffener by an adhesive or laminated onto the stiffener. The stiffener may be mounted onto the actuator arm by soldering or by laser welding.

[0010] Figure 2 provides an illustration of one embodiment of a head stack assembly with a flexible circuit substrate 201. A plurality of head gimbal assemblies may be coupled to the pivot bearing assembly 108. A suspension flexible circuit trace 202 may be attached to each load beam 106 and actuator arm 105, and may run from a transducer of each slider 107 to a single flexible circuit substrate 201. The flexible circuit substrate 201 may be made from an organic material. The actuator arm may be made of aluminum and manufactured by machining. The flexible circuit substrate 201 may be a substrate with a number of bond pads and a preamplifier chip 114 for signal processing. Each set of bond pads may be associated with a suspension flexible circuit trace 202. One or more leads running from the bond pads to the preamplifier 114 may be embedded in the flexible circuit substrate 201. The suspension flexible circuit trace 202 may be placed over these bonding pads on the flexible circuit substrate 201 to be electrically coupled to the flexible circuit substrate 201. To accomplish this, the termination pad of suspension flexible circuit trace 202 may be bonded to the corresponding bond pad on the flexible circuit substrate 201. For example, soldering or ultrasonic bonding may be used to connect the suspension flexible circuit trace 202 to the bond pads on the flexible circuit substrate 201 for a head stack assembly (HSA). One or more location pins 203 may be used to solder the flexible circuit substrate 201 in place. The location pins 203 would extend from the actuator arm 105 up through

the flexible circuit substrate 201. The flexible circuit substrate 201 may be connected to a control circuit 112 by a flexible circuit assembly 111. In addition to controlling the read/write functions of the transducer of the slider 107, the control circuit 112 may also control the movement of the actuator frame 109.

5 [0011] Figure 3 provides a cross-section illustration of one embodiment of the mounting of the flexible circuit substrate 201 on the actuator arm 105. The flexible circuit substrate 201 may be coupled to a stiffener 301 that facilitates mounting the flexible circuit substrate 201 to the actuator arm 105. The stiffener 301 may be made of aluminum, or some other durable material or metal. The flexible circuit  
10 substrate 201 may be coupled to the stiffener 301 using an adhesive, such as an epoxy. The preamplifier 114 and the suspension flexible circuit trace 202 bond pads 302 may be coupled to the flexible circuit substrate 201. One or more location pins 203 may extend up from the actuator arm 105 through the stiffener 301 and the flexible circuit substrate 201. The location pins 203 may be made from  
15 metal and mounted on the actuator arm 105 by press-fitting. The stiffener 301 and the flexible circuit substrate 201 may be then coupled to the location pins 203 by applying a solder ball 303 and soldering the stiffener 301 and flexible circuit substrate 201 in place.

[0012] Figure 4 provides an illustration of an alternate embodiment of a head  
20 stack assembly with a flexible circuit substrate 201. In this embodiment, the flexible circuit substrate 201 and stiffener 301 may be mounted on the actuator arm 105 using laser welding. The stiffener 301 may be laser welded to the actuator arm 105 at one or more points 401.

[0013] Figure 5 provides a cross-section illustration of the alternate  
25 embodiment of the mounting of the flexible circuit substrate 201 on the actuator arm 105. The flexible circuit substrate 201 and the stiffener 301 may be preliminarily combined with an adhesive and forms a lamination structure. Electrical elements 501 and bonding pads 302 may be added to the flexible circuit substrate 201 during the lamination process. The HSA circuit assembly may be aligned and then fixated

onto the plane of an actuator arm. One laser beam may be applied to the metal stiffener for a predetermined period of time to make the specific welding spot 401 between the stiffener 301 and flexible circuit substrate 201. The welding spots 401 may be produced by melting the metal stiffener 301 and actuator arm 105 by some means of concentrated heat energy, producing a fairly clean, non-contaminated connection. Good reliability and high bonding strength is achieved with this mounting operation, probably requiring no further cleaning. The welding spots 401 may be arranged on the metal stiffener 301 according to the needs and structure of specific HSA.

10 [0014] Although several embodiments are specifically illustrated and described herein, it will be appreciated that modifications and variations of the present invention are covered by the above teachings and within the purview of the appended claims without departing from the spirit and intended scope of the invention.

What is claimed is

1. A head stack assembly (HSA) circuit assembly, comprising:
  - at least one actuator pad to be electrically coupled to a printed circuit board;
  - a flexible circuit substrate to electrically couple a slider to the at least one actuator pad; and
  - a stiffener to be mounted between the flexible circuit substrate and an actuator arm.
- 5 2. The HSA circuit assembly of claim 1, wherein the stiffener is made of aluminum.
3. The HSA circuit assembly of claim 1, wherein the flexible circuit substrate is made of an organic material.
- 10 4. The HSA circuit assembly of claim 3, wherein the flexible circuit substrate has at least one embedded lead connecting the slider to the at least one actuator pad.
5. The HSA circuit assembly of claim 1, wherein the flexible circuit substrate is coupled to the stiffener with an adhesive.
- 15 6. The HSA circuit assembly of claim 1, wherein the stiffener is mounted to the actuator by soldering at least one pin extending from the actuator arm through the stiffener and the flexible substrate.
- 20 7. The flexible circuit assembly of claim 1, wherein the stiffener is mounted to the actuator by laser welding the stiffener to the actuator arm.
8. A head stack assembly, comprising:
  - an actuator arm to place a slider above a magnetic storage medium;

a printed circuit board to control the slider and the actuator arm; and  
a flexible circuit assembly, including:  
at least one actuator pads to be electrically coupled to a printed circuit board;  
a flexible circuit substrate to electrically couple a slider to the at least one  
actuator pad; and  
a stiffener to be mounted between the flexible circuit substrate and an actuator  
arm.

9. The head stack assembly of claim 8, wherein the stiffener is made of aluminum.

10. The head stack assembly of claim 8, wherein the flexible circuit substrate is  
made of an organic material.

11. The head stack assembly of claim 10, wherein the flexible circuit substrate has at  
least one embedded lead connecting the slider to the at least one actuator pad.

12. The head stack assembly of claim 8, wherein the flexible circuit substrate is  
coupled to the stiffener with an adhesive.

13. The head stack assembly of claim 8, further comprising at least one pin  
extending from the actuator arm through the stiffener to be soldered to the stiffener.

14. The head stack assembly of claim 8, wherein the stiffener is mounted to the  
actuator by laser welding the stiffener to the actuator arm.

15. A hard disk drive, comprising:

a magnetic storage medium to store data;  
a base to support the magnetic storage medium;  
an actuator arm to place a slider above a magnetic storage medium;

a pivot to move the actuator arm in relation to the magnetic storage medium;  
a printed circuit board to control the slider and the actuator arm; and  
a flexible circuit assembly, including:  
at least one actuator pad to be electrically coupled to a printed circuit board;  
a flexible circuit substrate to electrically couple a slider to the at least one actuator pad; and  
a stiffener to be mounted between the flexible circuit substrate and an actuator arm.

16. The hard disk drive of claim 15, wherein the stiffener is made of aluminum.

17. The hard disk drive of claim 15, wherein the flexible circuit substrate is made of an organic material.

18. The hard disk drive of claim 17, wherein the flexible circuit substrate has at least one embedded lead connecting the slider to the at least one actuator pad.

19. The hard disk drive of claim 15, wherein the flexible circuit substrate is coupled to the stiffener with an adhesive.

20. The hard disk drive of claim 15, further comprising at least one pin extending from the actuator arm through the stiffener to be soldered to the stiffener.

21. The hard disk drive of claim 15, wherein the stiffener is mounted to the actuator by laser welding the stiffener to the actuator arm.

22. A method, comprising:

electrically coupling a slider to at least one actuator pad with a flexible circuit substrate; and



mounting the flexible circuit substrate to an actuator arm with a stiffener between the flexible circuit substrate and the actuator arm.

23. The method of claim 22, wherein the stiffener is made of aluminum.

5

24. The method of claim 22, wherein the flexible circuit substrate is made of an organic material.

25. The method of claim 24, wherein the flexible circuit substrate has at least one embedded lead connecting the slider to the at least one actuator pad.

10

26. The method of claim 22, further comprising coupling the flexible circuit substrate to the stiffener with an adhesive.

15 27. The method of claim 22, further comprising mounting the stiffener to the actuator by soldering at least one pin extending from the actuator arm through the stiffener and the flexible substrate.

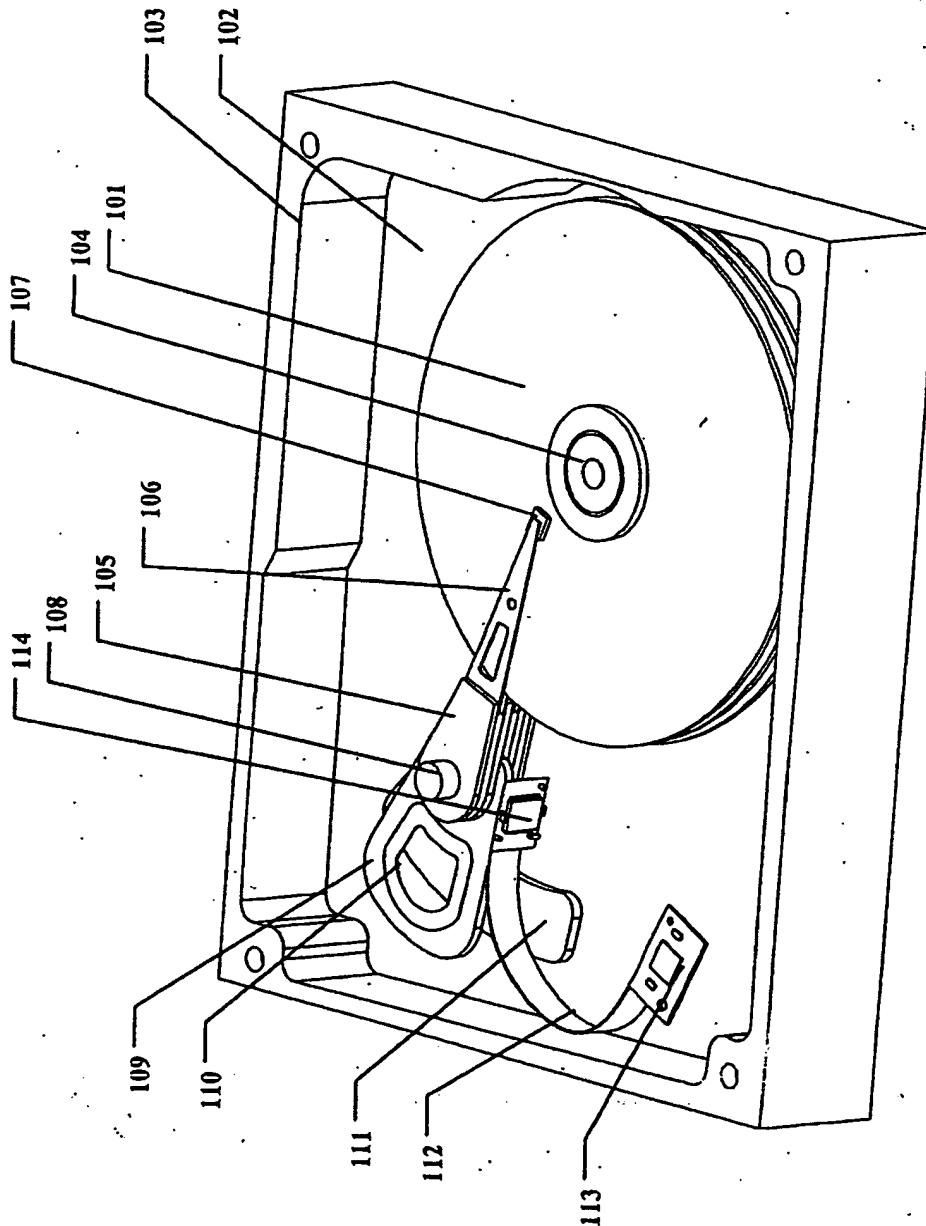
28. The method of claim 22, further comprising mounting the stiffener to the actuator by laser welding the stiffener to the actuator arm.

20

## Abstract

A method for mounting a head stack assembly (HSA) circuit assembly is disclosed. A flexible circuit substrate may be coupled to a stiffener. The stiffener  
5 may be a metal, such as aluminum, or some other stiff and durable material. The flexible circuit substrate may be made of an organic material and may have a series of electronic leads embedded in the flexible circuit substrate. The flexible substrate may be coupled to the stiffener by an adhesive or laminated onto the stiffener. The stiffener may be mounted onto the actuator arm by soldering or by  
10 laser welding.

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**Figure 1**  
(Prior Art)

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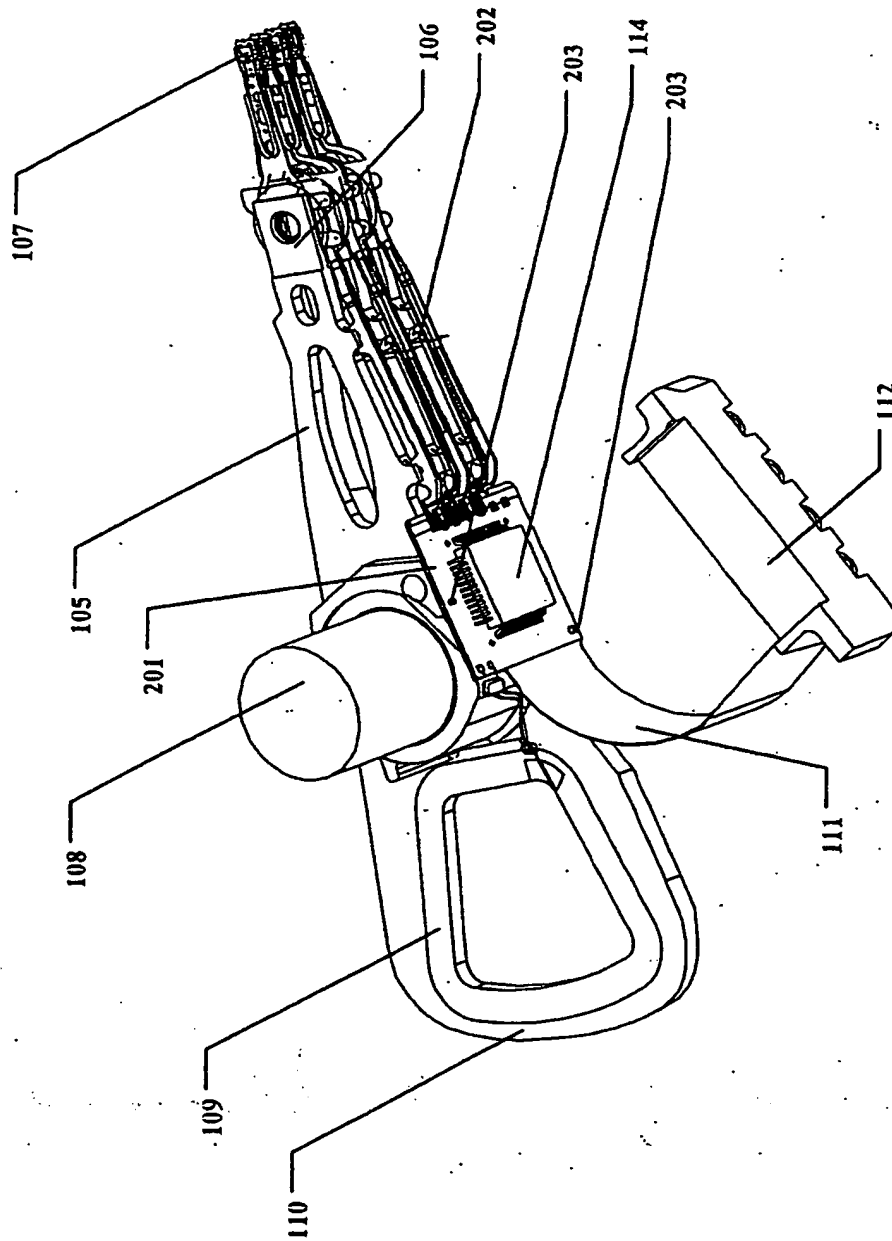


Figure 2

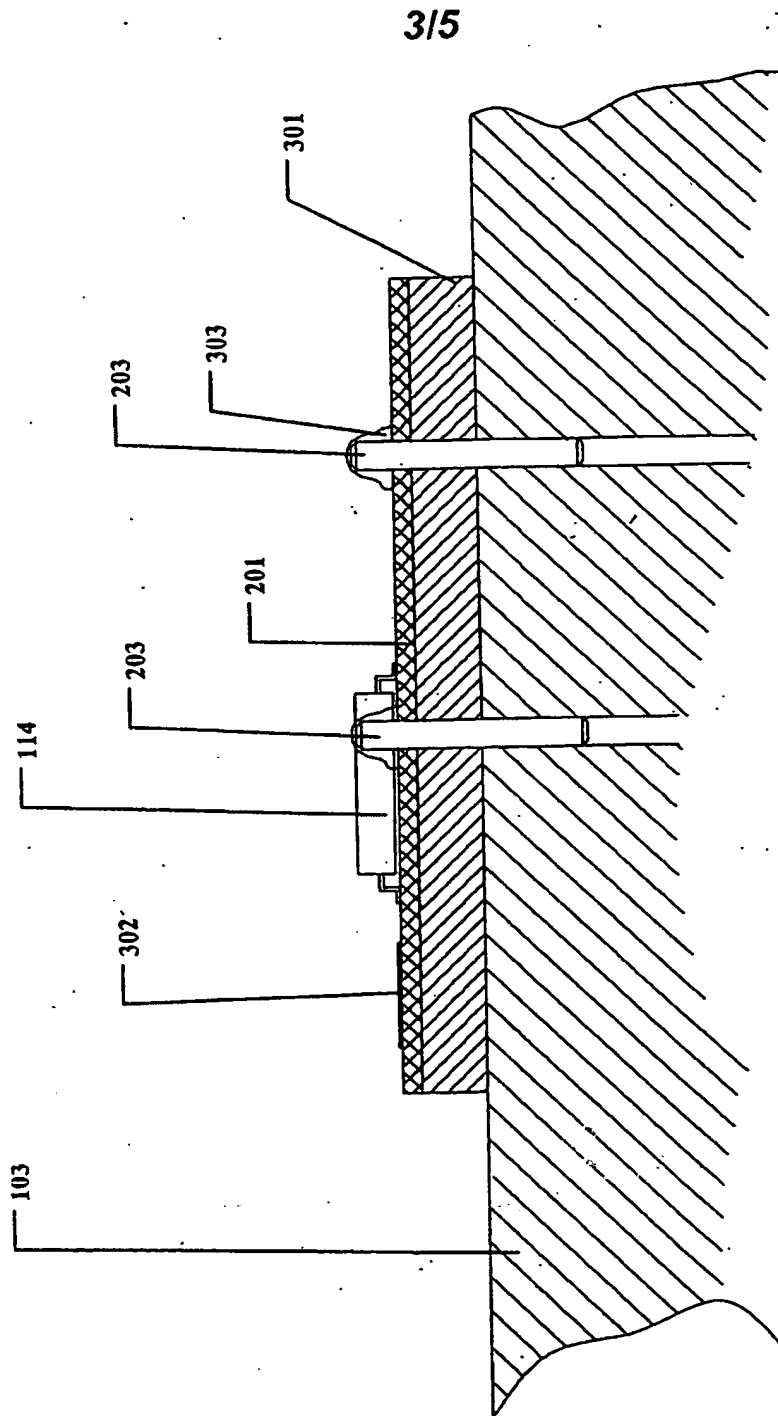


Figure 3

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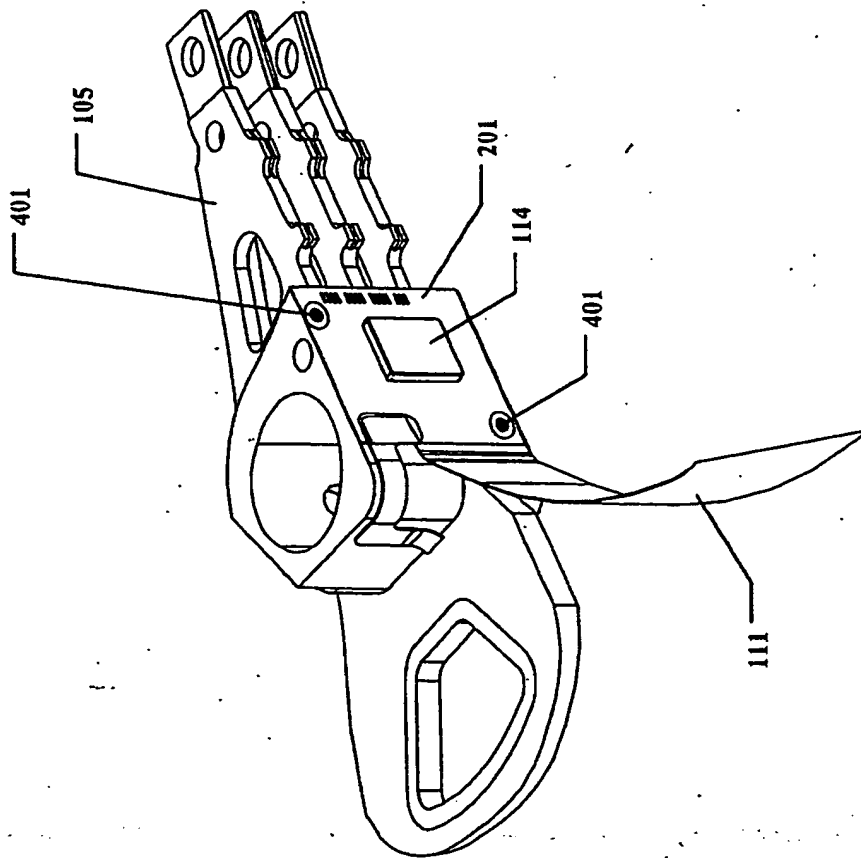


Figure 4

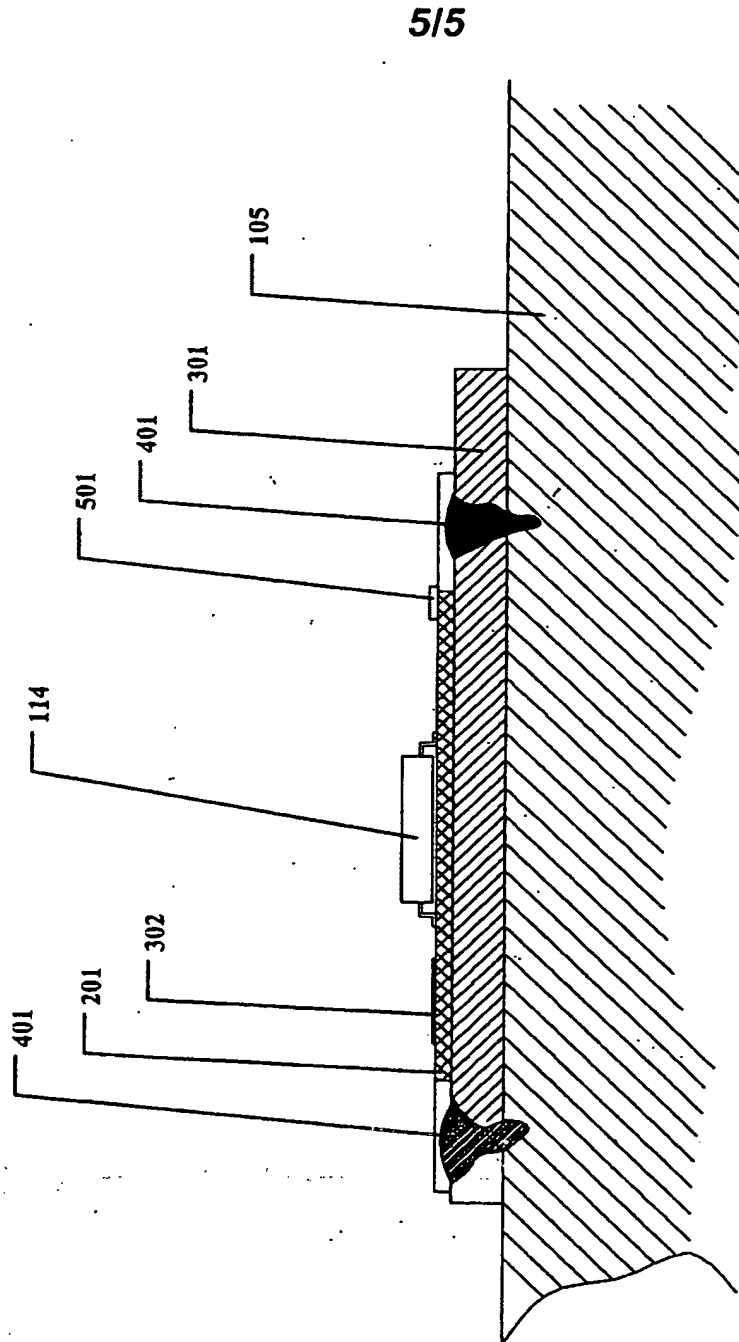


Figure 5